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AUTHOR Quevedo-Procel, Jose
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ABSTRACT

This paper describes the Mexican economic environment in terms of general economic conditions from the 1940s to the present, the role of science and technology in industrial progress, and the promotion and support of small companies. The technical entrepreneur is identified as the missing link that would play an important part in the technological and industrial progress of developing countries. The background and motivations of such entrepreneurs are discussed, and restraints on entrepreneurship such as financing and location are considered. The entrepreneurial environment, particularly the relationships between entrepreneurship and development, culture, and values are also discussed. INFOTEC--a Mexican government-owned institute providing various services to industry--is described, its role as a catalyst for the entrepreneurial process is analyzed, and five areas of INFOTEC activities are listed: (1) provision of technological information; (2) identification of potential sellers of technology; (3) assistance to entrepreneurs in identifying needs and business opportunities; (4) identification of potential users for available technology; and (5) providing the essential meeting grounds and brokerage between sellers and buyers. The bibliography lists 16 references. (MES)

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TECHNICAL ENTREPRENEURSHIP AND TECHNOLOGICAL PROGRESS IN
DEVELOPING COUNTRIES.

BY

JOSE QUEVEDO

EXECUTIVE DIRECTOR

OF

INFOTEC-MEXICO

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INTRODUCTION

I want to thank PROMOCET, and the United Nations Financing System for Science and Technology for Development for inviting me to participate in the seminar on "Industrial Linkages in Technological Development"

I work for INFOTEC which is a government owned institute that provides consulting, training, technological and marketing information services to industry whose activities, among other things, contribute to foster technical entrepreneurship, I shall make reference to some of our experiences and I shall also explain the activities of INFOTEC.

1. THE MEXICAN ENVIRONMENT

GENERAL ECONOMIC CONDITIONS.

Mexican Industrialization began in the mid-forties. From then to 1970, manufacturing production grew approximately 8 percent a year. The policies that were used to foster this industrial development were tools such as tariff protection, tax incentives, and financial aid. Industrialization of the country required imports of a great deal of capital goods and technology which resulted in an industry that produced consumer and intermediate goods to supply local markets, this put Mexico in a weak position to compete at an international level and brought about a continuous balance of payments problem.

Mexico grew rapidly -but not smoothly- between 1970 and 1982. Oil supported a strong expansion of public spending from 1979 to 1981. Both government and private investment were high, and there was plenty of internal and external credit available. A great expansion took place in that period, unfortunately the deficit in the government budget required credit from external sources which stimulated inflation and overvalued the Mexican currency. Between 1979 and 1981 the gross domestic product grew 7% per year, employment 5% and imports 30% per year in constant pesos, at the same time local industry was highly protected from foreign competition.

At present, Mexico is still struggling to get out of the financial and economic crisis whose origins can be traced to the second semester of 1981. Of course, one of the most pressing problems that Mexico faces is the generations of jobs. In connection with this the government and the private sector should establish strong, and sound policies to promote in general entrepreneurship, and in particular technical entrepreneurship, that would help to increase jobs, technological capabilities and be more prepared to export on the basis of competitive goods and services. Unfortunately I do not see any strong attitude, and solid/professional programs geared towards this end.

SCIENCE AND TECHNOLOGY

As regards this issue, I think the best thing I can say is that as long as developing countries, including Mexico, do not understand and accept the fact that the success of research and development is measured by commercial success in the marketplace, a lot of effort and money will continue to be wasted. This basic idea highlights the importance of technical entrepreneurship starting in the research and development function, that is, in the laboratory. Whenever I have mentioned this in Mexico, it is generally considered anathema. In practice this should be an open policy to stimulate scientists and engineers that are working in a laboratory either in a research institute or in industry to start their own business, and to provide all the necessary support and assistance to facilitate them the path to launch their new venture.

This basic idea has been the key to success of companies such as 3M in the United States, where entrepreneurship is a way of life; and is behind the development of highly entrepreneurial areas, such as Silicon Valley in California, and the well known Route 128 in Boston. In these places many companies have been the result of a spin-off from a research and development laboratory, such as the Lincoln Laboratories, or from technologically-oriented companies. To undertake this approach, research and development should be run like a business, which means there should be a proper mix of technical, marketing, and financial functions, instead of being a mere technical function; otherwise it will lose its indispensable business perspective. The practice of "technological entrepreneurship" could provide the missing link between the laboratory and the marketplace. This would be the most direct contribution of science and technology to employment, economic growth, exports, and general well being. However for this kind of entrepreneurship to flourish, a proper climate is required. The weak pro-business climate that still exists in many developing countries, together with the lack of a sound long term economic policy that produces a highly volatile and uncertain environment do not stimulate this kind of approach.

Generally speaking the role that science and technology is playing in the industrial progress of Mexico is at the infant level with few exceptions, efforts that have been undertaken during the last fifteen years, have been plagued by discontinuity, start-ups and shut-downs, that have hindered the accumulation of knowledge on how to manage science and technology as a tool for economic and social development. The formulation of science and technology policies within the framework of development strategy for a developing country, requires the accumulation of knowledge over a long period of time.

Within the science and technology policy for every country, a basic issue should be to foster technical entrepreneurship.

PROMOTION OF SMALL COMPANIES IN MEXICO.

The promotion and support of small and medium size companies in Mexico lies in the realm of the Ministry of Trade and Industry (Secretaría de Comercio y Fomento Industrial). Recently a decree was issued establishing a program for the development of small and medium size industry. This program is very general and does not incide directly nor effectively to stimulate the establishment of new companies and entrepreneurship.

In Nacional Financiera (the National Development Bank) several instruments to stimulate industry, and in particular small and medium size firms operate well and successfully. One of these funds provides credit to industry to undertake feasibility studies and projects for improvement by using external consultants (FONEP), INFOTEC is systematically being hired by small and medium size companies that use FONEP's credit to finance consulting projects to solve problems, profit from new opportunities, and to prepare projects and business plans for new ventures. A second, and very effective instrument is FOMIN, which provides risk and venture capital on a temporary basis, as well as convertible credit to promote new businesses. A third fund is called FOGAIN, which provides credit for working capital needs and for additional equipment purchases. Finally, FIDEIN is an instrument that builds and manages industrial parks and buildings to lodge small and medium size companies, either by purchasing or leasing space.

INFOTEC also operates as a trust in Nacional Financiera; I have already mentioned what we do, and later on, when talking about information and consulting services, I will reveal more specific aspects.

All the above mentioned instruments operate independently of one other, with a great freedom, and respond with a minimum of bureaucracy to the needs of industry. However, there is a programme that operates a group of industrial extension officers, that are scattered all over the country, who pay visits to industry, promoting the use of one or several of the instruments according to the specific needs of the companies they are in contact with. This program, called PAI, serves as an umbrella to coordinate the use of the various instruments that have been mentioned. INFOTEC has a contract with PAI to supply services to small and medium size companies, upon request of the industrial extension officers. These services are used to explore business opportunities or the solution of technical problems as well as to provide market and technical information required by the company.

THE MISSING LINK: THE TECHNICAL ENTREPRENEUR.

The technical entrepreneur is the high achiever professional manager, scientist, or engineer, that starts a new firm by himself or joining other entrepreneurs; whose main asset is the competitive advantage that he has by having accumulated knowledge, experience, and skills that allow him to fulfill needs that are not being satisfied, to improve existing processes/products, or to solve problems by using all his expertise.

Although, as I have mentioned, in Mexico there are several government agencies/instruments that work and assist technical entrepreneurs, they do it within the framework of wide programs, and there is no specific, well designed program to promote technical entrepreneurship. Circumstances have not been favorable for INFOTEC, and other agencies, such as FOMIN to undertake a well focused and aggressive approach towards fostering entrepreneurship, although we have thought about it for some time. There is no doubt that these individuals -the technical entrepreneurs- are the MISSING LINK in many developing countries that would play an important role in the technological and industrial progress of our countries.

11. WHO ARE THE ENTREPRENEURS?

BACKGROUND

In Mexico, most of the entrepreneurs are born into families that have a tradition in independent business. Their nature is more that of a doer than of a thinker.

Table 1. Occupation of Father and Grandfather (in Mexico).

<u>OCCUPATION</u>	<u>FATHER</u>	<u>GRANDFATHER</u>
- Industry	43	24
- Commerce	24	31
- Civil servant	13	4
- Professional	9	11
- Agriculture	7	19
- Banking	2	1.5
- Others	2	9.5
Total	100	100
Sample (N)	139	126

Source: Derossi, Flavia. El Empresario Mexicano.

Although recently several Mexican entrepreneurs have been known to start companies in their mid-forties, the typical technical entrepreneur is a man that started his business in his mid thirties; has acquired enough experience, skills, industrial knowledge, and self-confidence to prompt him to take advantage of business opportunities. The following table shows the working experience of 143 entrepreneurs in Mexico.

Table 2. Previous Professional Experience.

<u>SOURCE</u>	<u>%</u>
- Industry	58
- Professional (independent)	7
- Commerce	1
- Without Experience	34
Total	100

Source: Derossi, Flavia. El Empresario Mexicano.

Technical entrepreneurs are generally well educated people. In a sample of Mexican entrepreneurs, the majority (68 percent) had a university degree, 17 percent had some college level training, and only 15 percent had studied only high school. In the United States the typical entrepreneur has at least a bachelors degree in engineering; in areas with high entrepreneurial activity (Los Angeles and Boston) the median educational level is a master's degree. This is to be expected since the technical entrepreneur uses his knowledge as a competitive advantage for his company.

MOTIVATION

In the past, many people thought that the main reason for an entrepreneur to start a new company was to make money. This has proved to be wrong; once men have satisfied their basic needs, they work towards fulfilling their needs for achievement, power, and affiliation. Thus, money is but a means of measuring results and not the fundamental cause of undertaking a new venture.

The prime motivation for technical entrepreneurship is achievement. Starting a new company usually requires a higher amount of effort, energy and commitment than any other type of professional or business career.

Technical entrepreneurs are always setting challenges to make themselves put an extra effort into achieving a goal.

Technical entrepreneurs are not gamblers. They will participate in an event so long as they can influence the outcome by performing the work themselves.

Recent studies of very successful entrepreneurs classify engineers that have left their jobs in three categories: founders who want to start a company where they can stamp their managerial style, hustlers who jump at an opportunity and craftsmen entrepreneurs. Tikla S. Perry associate editor of the IEEE Spectrum interviewed 14 engineers turned to entrepreneurs in a wide variety of areas, and found that men in the three categories are individualists, cautious, did not consider themselves risk takers and believed that financial reward is secondary. All shared one characteristic, that of confidence in their own abilities. This behavior coincides with the one that we have observed in INFOTEC through several years of work, providing information, consulting and training services to entrepreneurs in Mexico.

Patrick R. Liles mentions there are three major influences on decisions to start companies. The first, deterioration of job satisfaction, releases the individual to consider seriously other career alternatives by making direct use of special skills and knowledge accumulated in prior positions.

Many engineers, frustrated with corporate bureaucracy, and having failed to convince management to take advantage of a marketing opportunity, have left their job to found their own company. As a result, companies that frustrate their professional employees have become a very important source and motivating factor for establishing new firms.

The second is that which derives from the possibility to identify a new business opportunity as it emerges over time. Working in a technical business, an engineer may learn or find out how to solve certain kinds of problems in such a way that he might apply to solve needs that his present employer is not aware of or interested in for business. In other instances, when suppliers are not properly satisfying the needs of a company, he can identify the key issues that are missing, and design a better product or service. Finally, when he sees potential opportunities for new businesses related to areas in which he is active, he will become motivated to start the new company if he can see himself playing an important role in it, which is determined by his perception of his own ability to take advantage of the opportunity.

The third major influence for an individual to start a company, and a very important one indeed, is encouragement and support. In Mexico, as in many parts of the world, there are no established channels or patterns on how to start one's own business. There is little or no encouragement in high schools or universities for engineering students to establish their own business. Education trains engineers to become supervisors or managers, not highly skilled technical entrepreneurs.

However, there are certain groups in Mexico, mainly immigrants, that have a very high rate of entrepreneurship, such as the Jewish community, Spanish immigrants, and some German immigrants. The special insights required to start a business of their own have come from relatives. To other people that have started their own business encouragement and advice has been, at least in Mexico, a matter of luck; this kind of role is played, nowadays, by venture capitalists in the United States. Many governments such as the French are taking initiatives to provide support, encouragement, and directions to "would-be-entrepreneurs".

Important support is needed in the preparation of detailed business plans, but support from other people that can join the potential entrepreneur by becoming part of the team that starts the new business is also required. If these individuals have complementary personalities and skills, the psychological support and encouragement that they can provide to each other can help overcome the problems of starting the new company and influence the success of the business.

Finally, the support that potential suppliers, consultants, lawyers, bankers, government officials, and other entrepreneurs can give an individual to help him overcome the barriers and problems of starting a new firm is fundamental to transforming an idea into a realistic and viable alternative. They can help him see things more clearly, providing him with the necessary technical, market, legal and other type of information; assess the opportunities available; and select the best one.

RESTRAINTS

One of the main, and most common restrictions in starting a new firm is the availability of adequate financing. In general, Mexican entrepreneurs have come to perceive banks as short terms lenders. Our experience in INFOTEC has clearly shown that banks are not prepared to evaluate the requirements of technically oriented projects properly.

In this sense, INFOTEC has acquired a sound experience by working together with FOMIN, which as I mentioned before is a successful financial institution established by the Mexican government to provide risk capital for new ventures by promoting investment in small and medium size companies in the private sector. Whenever FOMIN has to evaluate a technically oriented project, they request INFOTEC's technical consulting services to evaluate the project and provide all kinds of recommendations to the potential entrepreneur.

A common restraint found in Mexico has to do with location. New firms have no incentives to establish themselves in areas that have high industrial concentration. This is quite understandable from a macro-economic policy point of view, and I believe that such a policy should be applied to any corporation that wants to start a new company or plant. However it should not be applied across the board, since already established industry is a potential incubator of technical entrepreneurs that will have to take advantage of their relations with suppliers, information sources, connections with banks and with all kind of individuals (including his family), and institutions that can provide help and service.

Due to the high number of activities that have to undertaken in starting a business, entrepreneurs tend to start their firms, where they are already living and working, which simplifies the tasks of securing personnel and establishing relationships with the suppliers and customers by relaying in contacts made while still employed at the parent firm. In its industrial policy the State should establish all kind of measures to facilitate the establishment of new firms by technical entrepreneurs, wherever they can be started.

Finally, one of the most important restraints has to do with the success an individual has in his present job. Why should anyone satisfied with his career and present position like to start a new venture? If he is enjoying a good salary and fulfilling ever raising family financial needs; the decision becomes even harder. This suggests that strong stimulus has to be available in the environment, for a man to be attracted to quit his present position and start something new. Government, particularly in developing countries, should foster the entrepreneurial activities in every way and build a favorable climate and culture for business activities, in order to help potential entrepreneurs overcome the restrictions that are present and stimulate them to take the initiative. In Norway the only legal way to become a millionaire is to start a company as an entrepreneur!

RISK

The attitude of entrepreneurs toward risk has already been mentioned in a previous section of this chapter. However it is worth saying that the successful entrepreneurs I know of, are not high risk takers; they take risk starting and managing their own business and see it as a challenge. Entrepreneurs take moderate risks, which means they try to take the right risks. Since risk is inherent to every entrepreneurial activity, the use of professional management consultants to assist them on their planning can be very important in helping them take the right moderate risks.

III. THE ENTREPRENEURIAL ENVIRONMENT.

ENTREPRENEURSHIP AND DEVELOPMENT

In 1974 I was invited to give a lecture by the World Federation of Engineering Organizations on the subject: Information requirements in industrializing economies. I explained that when we started INFOTEC, we had to keep in mind that setting up an information and technical assistance service (later on we added consulting and training) required the use of broad criteria in judgement, which had to take into account both the social and the economic development of the country, since this form is an iterative process in the growth of Mexico (or any country). It is not possible to think that economic development can take place without raising the levels of education, science, and culture. There is no doubt that the educational system plays a fundamental role in the capacity to absorb technology and to use it as a starting point to create domestic technology. The attitudes towards innovation and entrepreneurship are also strongly influenced by the educational and cultural environment of the nation.

There is no doubt that a very important link between the social and economic development of a country is the entrepreneur. It is necessary to use the entrepreneur's talent to turn other resources into profitable enterprises. It is necessary to focus industrial and technological development policies on the human factor; the entrepreneur, by whose talent, abilities, experience, and need for achievement, resources such as land, labor, capital, and knowledge are transformed into new products and businesses which are competitive and capable of participating in the modern business world.

Most Latin American countries, among them Mexico, need to give serious attention -and not lip service- to the individuals who have ability to become entrepreneurs, and to ease their path by fostering freedom of action and an open and competitive social structure geared towards excellence.

The adoption of a policy to stimulate technical entrepreneurs to start modern small enterprises, needs to overcome two major barriers prevalent in many developing countries: first, a culture of passivity/frustration and fatalism about their own destiny, and second, lack of orientation and planning towards the future. It is necessary that governments -of developing countries- provide a sound economic policy where risks and volatility in the environment are minimized and establish a culture so that would-be entrepreneurs are allowed to play their role in the growth of the country.

In connection with entrepreneurship and development it is necessary to examine some facts. In the last twenty years the number of people employed in paid jobs in the United States of America grew from 71 to 106 million. In particular the number of jobs created from 1974 to 1984 were 24 million. It is interesting to remember that by the end of 1973 an era of very high turbulence and volatility was sparked off by the oil crisis. The traditional industries suffered a lot of damage in the recession created by this event, actually The Fortune 500 Largest Companies in the United States, together with government and universities have lost at least 5 million jobs since 1970. This means that a total of about 40 million jobs have been created. The outstanding fact is that this employment generation has taken place in small and medium size institutions, the great majority being small and medium size business which mostly did not exist twenty years ago. In contrast, Western Europe has lost about 4 million jobs since 1970.

What explains the difference in economic behavior between the United States of America and the other countries is one single element: the entrepreneur.

Now, let us take a look at what successful large companies in the United States are doing. Competition is becoming more intense in the mid-eighties, and large companies either innovate and turn good ideas into profits or they disappear. Since innovation has become essential as a competitive tool, companies have learned how to manage it effectively. The only way to do this is by establishing a climate of freedom within the company to stimulate the would-be entrepreneur to flourish within the company, instead of leaving him to start a new venture. These internal entrepreneurs are now being called "intrapreneurs". Gifford Pinchot's definition of an intrapreneur is:

Any of the "dreamers who do". Those who take hands-on responsibility for creating innovation of any kind within an organization. The intrapreneur may be the creator or inventor but is always the dreamer who figures out how to turn an idea into a profitable reality. Intrapreneurs will make all the difference between a firm's success and failure. Intrapreneurs are the integrators who combine the talents of both the technologists and the marketers by establishing new products, processes, and services. Without them innovation remains potential.

People have asked, why would anyone choose to be intrapreneur, instead of becoming an entrepreneur? Big companies can provide large resources to support an individual's idea and initiative, facilitating his job. On the other hand, we have already stated that the main motivation for entrepreneurs is not money but the satisfaction of a personal need for achievement. Thus if an intrapreneur leaves a company it is not because he does not get enough money but because he feels frustrated by the blockade exerted by bureaucratic systems (analysis and controls) on his attempts to innovate.

Money for an entrepreneur is a measure of success, and also -very important- a way to earn freedom to act, to try new ideas without having to justify every moment and get approval from a boss; thus, conditions for intrapreneurs have to be established for them to flourish.

Anders Wall, President and Chief Executive of Beijer-Invest of Sweden, a European conglomerate that includes, among many other companies, Volvo said:

"Today we must support people with ideas and initiative -the entrepreneurs- because they are agents of change and our hope for the future. Experience shows that successful companies are those who have initiated change in technology, marketing or organization and managed to keep a lead in changes over competitors. Therefore, entrepreneurs are needed not only to start new business ventures on a small scale, but also to put life into existing companies, especially the large ones.

The trouble is entrepreneurs and large companies do not seem to get on well together, although they should need each other. The entrepreneur needs the resources of a large company to try this ideas on. The large company needs the innovative force and initiative of an entrepreneur. But the entrepreneurs likes to be his own boss and the organization of large company usually gives little room for independence".

Gifford Pinchot adds to the above that, "for a brief time we believe that carefully planned new-product processes could replace the disorder of entrepreneurial passion. Study after study has proved his false. Innovation almost never happens in large organizations without an individual or small group passionately dedicated to making it happen. When such people start-up new companies, they are called entrepreneurs. Inside large organizations they are called intrapreneurs".

The success that the United States of America has had in creating new jobs, most of them in small and medium size businesses, and the success of large corporations in America, and some in Europe, such as the Swedish company that was mentioned, indicates that there is no doubt that entrepreneurship can be fostered. What countries, mainly the newly industrialized ones, have to do -as I have already mentioned- is to focus their industrial and technological development strategies on the human factor. This is the way to create, what Peter Drucker calls, an "entrepreneurial economy".

CAN ENTREPRENEURS BE TRAINED?

I have to quote P. Drucker who recently wrote: "The best proof that entrepreneurship is a question of behavior, policies, and practices rather than personality, is the growing number of older large-company people in the United States of America who make entrepreneurship their second career. Increasingly, middle-and-upper-level executives and senior professionals who have spent their entire working lives in large companies, take early retirement at fifty or fifty-five, then become entrepreneurs. Some start their own businesses. Some, especially technical specialists, set up shop as consultants to new and small ventures. Some join a new small venture in a senior position. And the great majority are both successful and happy in their new assignments".

These people to which Drucker refers, have been trained on-the-job to become entrepreneurs. To be sure they have acquired:

- 1) knowledge (on technical, financial, marketing, and management issues).
- 2) a strong self-confidence
- 3) experience of working hard and persistently
- 4) self discipline
- 5) adaptability
- 6) networks and contacts, and
- 7) capital (or economic independence)

On the other hand, there are many books written on the subject, such as: THE ENTREPRENEURS MANUAL, NEW BUSINESS VENTURES, THE ENTREPRENEUR'S HANDBOOK, HOW TO START, FINANCE AND MANAGE YOUR OWN SMALL BUSINESS, THE PRACTICE OF ENTREPRENEURSHIP, and many others that can be used as tools for training.

CULTURE AND VALUES ARE NEEDED.

I have already mentioned in this paper many issues connected with culture and values. If we are witnessing how an entrepreneurial economy is taking place in the United States, and how this is starting to be imitated by other countries -even China is taking some steps in the entrepreneurial direction- there is no doubt that culture and values are needed for entrepreneurs to flourish.

The fundamental problem with most of the developing countries, is that there is a hostile environment towards entrepreneurship; as long as this prevails, policies to promote new companies, will at best show scant results. It has to be kept in mind that, by definition, entrepreneurs are human beings, and their behavior will be conditioned by what is in their minds and hearts, and this in turn will be shaped by the values, myths, heroes, and symbols that integrate a culture. The culture of a particular country defines, "the way things are done"; thus culture plays a key role on the success of a country in establishing an entrepreneurial economy.

In Mexico a change of attitude has to take place. We are in a country where we have always heard that "it is institutions that count", human beings are "transient". We need to recognize that people make institutions work; and culture, whether at a macroeconomic or microeconomic level, ties people together and gives meaning and purpose to their day-to-day life. Culture has to pervade throughout the whole system; mainly in the educational institutions, in industrial strategy, in the political arena, and in science and technology. Culture can not be shaped or change overnight. It takes many years and hard and persistent work to change a culture.

In the case of entrepreneurship, the most important elements of culture that have to be established deal with:

- The business environment. This is established by the general attitude and conditions towards business (fiscal incentives, availability of credit and venture capital, attitude of bankers with regard to technical entrepreneurs, size of market, competitors, information and consulting services available, education, and political attitudes).
- Values. Are formed by the fundamental beliefs and concepts that define success. They provide a sense of common direction for all industry and entrepreneurs.

- Heroes. These are the people that personify the values by playing the role of models for the society as a whole. In order for technical entrepreneurship to flourish, this kind of men need to be honored; such as, Mr. Soichiro Honda, founder and builder of Honda Motor Company has been honored in Japan.
- The rites and rituals. These are the systematic and programmed routines of daily life in a society that show the people the kind of behavior that is expected. This is exemplified by the contest that annually takes place among Japanese companies to win the quality certificate that the Japan Union of Scientists and Engineers (JUSE) awards to the best companies. In this kind of rites and rituals even a TV program at a national level takes place. Something similar should take place to give an award to the entrepreneur of the year, if we want to foster entrepreneurship. In this sense the heroes are the soul of the culture, they become the great motivators, and show that the ideal of success exists within human capacity.
- The cultural network. Should be integrated by all the people and means of communication within a society that transmit the messages of the various elements of the culture, and follow-up news on a day-to-day basis about what is happening with the elements of this culture, thus showing people how to behave.

VENTURE FINANCING IN MEXICO.

The concept of venture capital is a rather simple one. When a new company is going to start-up, money contributed by outside investors in return for an equity position, is called venture capital. When the company grows and prospers, the value of that equity position will rise. In the medium or long term the value of the equity position can be converted by the investor into cash, at a much higher value -depending on the success of the company- than the original investment.

In Mexico private venture capital business has not been developed, and the source of venture capital for a potential entrepreneur is FOMIN, that constitutes an instrument to provide venture capital for new companies.

The participation of FOMIN as stockholder is limited to a maximum of 49% of the stockholders equity, and can be in two forms. First participating as a stockholder on a temporary basis, and second as a source of credit that can be converted to equity. When FOMIN provides venture capital, it participates on the board of directors of the company, without interfering nor being responsible for the management of the company. If the company is successful FOMIN will eventually sell its share, in order to use the proceeds to promote another new venture; having participated, during the last decade, in the launching of 150 companies, and having sold its share of 50 of them.

IV. INNOVATION AND THE ENTREPRENEUR.

TECHNICAL ENTREPRENEURSHIP

In order for developing countries to continue to grow, provide employment and increase their exports many new companies will have to be established; existing companies will have to improve and develop new products or processes. The real threat to a country that has plenty of raw materials -such as Mexico- is the availability of entrepreneurial resources and suitable projects. This is turning out to be the main constraining factor. Although Mexico is facing financial limitations, there is still capital available to start new ventures.

In addition to a positive climate, building a strong technical base is a necessary condition in the success of fostering new companies and entrepreneurship. Thus help and assistance is required in areas such as identifying and evaluating business opportunities, project formulation and evaluation, and most important, persuing the projects.

Resources needed are available mainly to large groups; new entrepreneurs are needed in order to diversify industrial development, and avoid oligopolistic tendencies. Entrepreneurs not only need access to capital, but even more important, to gain access to technology available to them. This will enhance and facilitate the entrepreneurial process.

It is important to mention that this by no means implies that big industrial groups should not play a major role in the industrialization process, or that they should not get support.

It is well known that the economic growth of developing countries has been the result of investment and very little, if any, the result of technological innovation. The introduction of the innovation component in economic development of these countries is urgently needed to make it possible for them to participate in the modern business world.

To introduce innovation it is necessary to stimulate entrepreneurship in industry, and intrapreneurship inside existing companies; the result would be a constant search for ways to solve technical problems, increase productivity, improve existing processes and products, develop new ones, and take advantage of business oportunities, both at national and international levels.

PHASES OF THE ENTREPRENEURIAL PROCESS.

Developing countries need to have instruments that provide inputs that foster the entrepreneurial process. These instruments are similar to the ones I have already mentioned that work as trusts in the National Development Bank in Mexico. In addition, there is an instrument that operates as a trust fund in the Central Bank (Bank of Mexico) which contributes substantially to the industrial progress of the country. It is FONEI, which provides credit to medium and large companies for equipment, working capital, and research and development projects. Particularly FONEI, has been playing a very successful role in stimulating and providing support to industry.

All the instruments that have been mentioned are geared towards working as catalysts of the entrepreneurial process in Mexico. Let us now analyze INFOTEC's role as a catalyst.

INFOTEC has been emphasizing and developing its activities in those areas which create the opportunity for industrial development and technology transfer, and that enhance the entrepreneurial process. These areas are:

- 1) The provision of technological information (which is knowledge -technical, economic, marketing, managerial, social, etc.- that by its application will, further progress in the form of improvement and innovation).
- 2) Identification of potential sellers of technology.
- 3) Assistance to entrepreneurs in identifying their needs through the selection process which includes:
 - a) Identification of business opportunities
 - b) Market studies
 - c) Project formulation and evaluation
 - d) Design of new products and processes
 - e) Strategic planning
- 4) Identification of potential users for appropriate available technology.
- 5) Providing the essential meeting grounds and "brokerage" between sellers and buyers.

IDENTIFICATION OF OPPORTUNITIES.

I have already mentioned the identification of a business opportunity for a technical entrepreneur, usually emerges over time. The roots for identifying opportunities lay in the accumulated knowledge (technical and of industry structure and market), skills, and abilities of the potential entrepreneur, or in his relation with suppliers. In any circumstance, entrepreneurs need a constant flow of information and knowledge about their markets, upon which to base their decisions.

INFOTEC as an instrument for enhancing the entrepreneurial processs provides market information and conducts market studies for its clients, it also combines these services with consulting for identifying business opportunities for small and medium size firms by using creative methods that generate ideas for new products and new business.

INFOTEC is starting to play a more active role in the identification of business opportunities. Together with FOMIN, we have thought that we should not wait for specific client requests, but should be ahead of our clients detecting future needs; sourcing technology, stimulating potential entrepreneurs and existing firms to make use of it; and developing awareness among them.

The Sequence

The sequence of events should therefore be:

- 1) Identifying areas of potential interest which will need technological inputs.
- 2) Screening and sourcing appropriate sources of technology.
- 3) Analyzing the marketing and financial aspects of the specific opportunity.
- 4) Making the potential clientele (entrepreneurs and existing firms) aware of it (awareness program).
- 5) When needed, bringing the technology source and the receiver together (acting as a broker).
- 6) When appropriate, providing assistance in setting the grounds for the entrepreneurial stage by preparing project formulation and evaluation.

There are several tools that have to be used for identifying and promoting business opportunities. The first one being the multiclient project approach. This is the one that INFOTEC has started to undertake, and plans to be more active in the near future.

The multiclient projects are an old idea, that seem to be helping INFOTEC play its role as a catalyst in the entrepreneurial process, by helping to identify business opportunities. INFOTEC has finished two of these projects. The first one "The Mexican Market for Mills, Crushers and Complementary Equipment 1984-1990", and the second "Synthetic Resins in Mexico 1970-1987".

SOURCES OF INFORMATION

The importance of innovation and entrepreneurship has already been discussed. In building-up a positive environment for innovation and technical entrepreneurship, information in written and non-written form plays the role of an intellectual raw material, which is transformed to final, and hopefully, practical results (goods and services) by human beings. If developing countries want to grow and to have a fair share of the world's wealth, what they have to do is to foster the growth of people by helping them to become more knowledgeable and by helping them to use information as a working tool, both at the educational level and at the professional level.

The fundamental element in innovation and in technical entrepreneurship is knowledge, knowledge of any kind, which by its application will further progress in the form of improvements. The capacity to use and apply knowledge as a tool for development is neither evenly nor fairly distributed among countries, at a time when existing knowledge is enormous and the rate of generation of new knowledge is very high.

Since information is the vehicle for knowledge, the capacity to manage it efficiently and to market it effectively in developing countries must be built with care. This capacity will then serve as a base to generate new knowledge to satisfy local needs of the society, which will profit from its comparative advantages at an international level.

Developing nations must learn how to benefit from their natural resources mainly by learning how to use knowledge as an economic resource by creating and strengthening technological information services. This is one of the best tools to enhance the entrepreneurial process and to stimulate innovation.

Industrial strategy in developing countries has to maintain -when possible- an adequate balance of large enterprises and small and medium size firms.

The needs of large companies are -of course- different from those of the small and medium size firms or the would-be entrepreneur. Knowledge flows into the big firm through specialized and qualified human resources in several functional areas, such as marketing, engineering, research and development, purchasing, quality control, finance, accounting, and industrial relations. These companies develop and up-date their personnel by encouraging them to actively participate in professional and industrial associations, by sending them to congresses, symposia, exhibitions, and foreign plants, by hiring consultants, by acquiring books, handbooks, periodicals, and so on. This type of company must only formalize and sistematize the flow and the application of knowledge by organizing an efficient and effective system to manage information and its use in operations, in research and development, and in long range planning.

Small and medium size firms have an inherent lack of resources that hinders their obtaining all the specialized human resources that they need. Generally such a company is understaffed, and professionals and technicians are thus too busy with day-to-day operations to solve the problems and profit from the opportunities that they face. The smaller the company, the less likely is its staff to have the time and training to take a rational approach to identify and define its information and technical assistance requirements.

Technological information services have to take into consideration both, the above stated realities and the fact that small and medium size firms are often one-man-show (the technical entrepreneur) companies. This means that the service must not only promote its own services and gain the confidence of the company but that it must educate and develop the entrepreneur, professional and technician. Services also need to include an ingredient of help on a do-it-yourself basis, by providing evaluated, repackaged, and processed information that will increase the user's knowledge, and stimulate the men in industry to take the action which is, finally, their responsibility and thus must be taken on their own initiative.

INFOTEC's Information Services comprise:

- The largest collection of information in the country of:

- | | |
|----------------------------|-----------------------|
| - Patents | - Industry profiles |
| - Standards | - Journals |
| - Indexes and abstracts | - Economic indicators |
| - International data bases | - Directories |
| - Manufacturers' catalogs | |

- Publications:

Technical News, a monthly review of relevant articles in 12 areas of major interest to manufacturers.

Alertec Bulletin, a bimonthly publication that offers a brief review of technical documents selected from the data base of the National Technical Information Service.

- Representations:

INFOTEC represents the following organizations in their publication services:

- The Asian Productivity Organization
- The World Bank
- The National Technical Information Service

- Technological Information Program:

This is an annual membership program which integrates a number of services specially directed to small and medium companies that entitles them to the following:

- ° Expert advice by a member of our Industrial Consulting Service in technological, economic or commercial matters.
- ° INFOTEC's information resources.
- ° Discounts in other services.

- Documentation:

INFOTEC is able to provide all kinds of national and foreign publications.

CONSULTING SERVICES REQUIRED

A research on "Technological Entrepreneurship" undertaken by the University of Michigan, showed that the use of consultants were common in all areas of technological ventures. Consultants were used more extensively in the priority areas of accounting, marketing, production, and engineering and research and development. The accounting function received the most support from consultants. The next most frequently supported function was research and development, followed by finance and marketing.

INFOTEC offers to industry and would-be entrepreneurs a wide range of consulting services, that have proved to be quite successful for Mexican companies.

TECHNOLOGY TRANSFER

- Identification of technology sources
- Evaluation of technological options
- Technology valuation
- Licensing

ANALYSIS OF BUSINESS OPPORTUNITIES

- Identification of business opportunities
- Market research for industrial products
- Feasibility studies
- Competitive analysis

DEVELOPMENT OF NEW PRODUCTS AND PROCESSES

- Product and process improvement
- Design of new products
- Design of new processes
- Selection of machinery and equipment
- Problem solving

TECHNOLOGY MANAGEMENT

- Management of technological innovation
- Strategic and technology planning
- Technology forecasting
- Vulnerability analysis
- Technology and market monitoring
- Information and intelligence systems
- Patent strategy

V. CONCLUSIONS

1. The fact that success of R&D is measured by commercial success in the marketplace has to be accepted; thus that R&D has to be run like a business.
2. The educational system, at all levels, should include values, heroes, rites and rituals enhancing entrepreneurship.
3. It is necessary to develop and strengthen the infrastructure of banking, consulting, and technological information services that can play the role of catalysts in the entrepreneurial process.
4. It is necessary to facilitate the establishment of new technical firms wherever they can be started.
5. It is a "must" to undertake all the necessary steps to establish a culture to enhance technical entrepreneurship.
6. It is important to foster the establishment of a "private venture capital business".
7. A sound long term economic policy to reduce volatility and uncertainty has to be established.

FINAL CONCLUSION:

Focus industrial and technological development strategies on the "HUMAN FACTOR", recognizing that people make institutions and enterprises work.

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